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# THREE CASES OF CEREBRAL ABSCESS CONSEQUENT UPON SUPPURATIVE DISEASE OF THE MIDDLE EAR, WITH REMARKS.

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GENTLEMEN,—In inviting your attention, this evening, to the fatal consequences which are sometimes developed out of suppurative diseases of the ear, I venture to say that the importance of the subject is in inverse proportion to the attention which medical men have hitherto devoted to it. Discharge from the ear is, I fear, in too many cases, viewed with indifference by the profession, as well as by the public. Why is it thought so lightly of by some members of the profession? I believe it is very much from a want of due appreciation of the real source of the discharge. Otorrhoea is not a disease, but the result of disease. It is, in the great majority of cases, really an expression of a diseased process in the deep parts of the ear within the tympanic membrane.

The purulent matter from the simple "running ear" which has lasted for any length of time, is, with few exceptions, secreted by the mucous lining of the middle ear, in whole or in part, and escapes thence through a perforation in the tympanic membrane, which may vary in size from a pin point to almost total destruction. By the middle ear anatomists understand the tympanum, Eustachian tube, and mastoid cells. If we exclude the cartilaginous part of the Eustachian tube, the middle ear consists of cavities hollowed out in the temporal bone, filled with air and lined by a mucous membrane in the most intimate nutritive relation with the periosteum beneath. It is very important to keep in mind this remarkable anatom-

ical feature of the temporal bone—viz., the numerous hollow spaces (one of which—the antrum mastoideum—is almost as large as the tympanic cavity itself) which are found chiefly in the mastoid and petrous portions, but are found also in other parts of the bone. These cavities all communicate freely with the tympanum, and are apt to participate in suppurative processes which may originate there. The cells situated in the mastoid bone are separated from the dura mater only by a thin cortex of bone, just in the situation of the lateral sinus, while the tympanum itself at its roof has but a very thin plate of bone, which is often in fact defective, separating its mucous membrane from the dura mater.

In addition to the dangers which may at any time arise from the proximity of these osseous spaces to the vital parts within the cranium, the anatomical arrangement just referred to presents very favourable conditions for the retention, accumulation, and decomposition of the purulent secretion. The decomposing pus, loaded with bacteria, stored up in these cellular spaces may often remain, sometimes dried up into cheesy looking masses, many years without disturbance; but it may also lead suddenly to rapid ulcerative conditions in the neighbourhood, or, by absorption, to fatal embolic and septic diseases. Besides, the gases of decomposition which arise from these putrefying masses do not merely pass outwards, where they fall very unpleasantly upon our sense of smell, but they may pass upwards upon the brain itself, and exert an irritating and putrefactive influence there. When we consider that the roof of the tympanum and mastoid cells is often very thin, sometimes at parts only membranous, and always perforated by foramina, it is easy to understand that these emanating gases may gain admission to the cranial cavity.

We thus see that the source, in most cases, of discharges from the ear, is an inflamed mucous membrane, which is so intimately connected with the periosteum as to threaten to invest the disease with all the gravity of a periostitis. All surgeons recognise periostitis, with the attendant danger of caries and necrosis, as a serious affection in any bone of the body; but in a cranial bone, and especially in the temporal bone, it has a much more weighty significance. In short, Gentlemen, I do not know any part of the body where, from a theoretical standpoint, we should so earnestly strive to avert inflammatory processes and accumulation of purulent secretion. The following three cases, which have come under my observation during the past two years, show that practical experience bears out this *a priori* statement. I should men-

tion that one of these cases—the first one—has already been reported by me in detail, in the *Glasgow Medical Journal* of May, 1878, but for purposes of comparison I have summarised it in my paper to-night.

CASE I.—S. S., a strong, healthy boy, 14 years of age, suffered for ten years from a “running ear” on the left side, originating in measles. On Monday, 31st December, 1877, he was seized with severe pain in the ear and side of the head, after a slap with the open hand from his master. The pain was soon followed by severe and persistent vomiting, and by considerable feverishness. These symptoms continued, the pain in the side of the head being very intense, until the eleventh day of his illness, when he became comatose, and his arms and hands remained in a state of spasmodic contraction. Death followed two hours afterwards.

*Post-mortem* examination revealed a large abscess, having a very fetid odour, in the left temporal lobe of the brain, in the portion lying over the roof of the tympanum. The dura mater over the *tegmen tympani* was softened and thickened, but there was no opening in the bone communicating with the tympanum, and, indeed, no caries could be found in any part of the temporal bone. The tympanic membrane was found to be destroyed, while a soft polypous growth, and some granulation tissue occupied the greater part of the cavity of the tympanum. The malleus and incus lay loose in the upper part of the cavity, embedded in a brownish semi-fluid substance, which emitted a most fetid odour. The stapes could not be found.

CASE II.—J. L. M., a lad, 17 years of age, of a very lively disposition, began to suffer from defective hearing in the left ear at the age of eleven years. This continued, sometimes better and sometimes worse, and for two years before his fatal illness, there was also an intermittent purulent discharge from the same ear. This discharge was occasionally attended with pain, though at no time of a severe character, and generally had a very offensive odour. He had usually a fresh complexion, and had been a healthy child; but two brothers had died of tubercular meningitis. Two months previous to his death he spent his holidays at Millport, when, as his father expressed it, he was never happy unless when boating, or fishing, or climbing the hills—in which he excelled his companions. Before the discharge from the ear began, certain lotions were poured into the ear for the relief of the deafness, while the discharge was treated with occasional syringing with warm water. No aural specialist was, however, consulted.



While at the coast in July, he was very fond of bathing in the sea; but he stopped it, remarking to his mother that he thought it injured his head. After he came home from the seaside, it was observed that he was losing his freshness, and he frequently complained of headache, binding his head with a handkerchief, which seemed to make it more comfortable. On Sunday, the 7th September, 1879, he complained a little of this pain in the head, and on the following day he went to business, although he felt very unwell. In the evening he attended a French class as usual; but immediately on coming home he went to bed, saying he could hold out no longer. During the Monday night and the Tuesday morning he vomited frequently, this being followed by a strange feeling of prostration. After the first twenty-four hours he did not vomit again until the Monday and Tuesday of the following week, when it was repeated on two occasions after partaking of egg. The pain was limited to the left side of the forehead, and it was easier when he lay on his back; he said that when he lay on his left side he felt as if some "stuff" ran from one side to the other." The pain, however, only continued the first two or three days, and was not at any time intense.

There was a slight form of aphasia from an early period of the illness. He failed to remember the name of the street in which he lived, and when he wished to refer to Partiek (a place visited by him daily when well) he could only point in the direction of Partiek and say, "that place near to Glasgow;" he could not even remember his own name. This aphasic condition continued to the end of the illness. I was asked to see him four days after the beginning of his illness, in order to treat the "running ear." I found, in addition to the symptoms mentioned, that the patient complained of a peculiar feeling in his head, sometimes a heaviness and sometimes a sensation as if he had two heads; and also, that he was very drowsy, although unable to get calm sleep. He was able to take some food. His bowels were constipated. There was no feverishness. In view of these symptoms and suspicions of a grave intra-cranial disease, I resolved in the meantime to refrain from any purely aural treatment, contenting myself with clearing the pus out of the auditory canal, and examining the deeper parts, when I found a large part of the tympanic membrane gone at the upper part.

These symptoms went on—namely, the aphasia, the drowsiness (he generally lay on his back with his eyes closed, but when roused spoke intelligently), and the peculiar feelings in his head—and on the following Thursday, ten days after the

onset of the vomiting, he was able to walk, in the forenoon, with a staggering gait, from the dining room to the kitchen. On the afternoon of that day, while on the sofa in the act of eating a piece of chop, his father being seated beside him, he was seized with a general trembling, and became completely unconscious. This comatose condition lasted for about two hours. I saw him two hours after he recovered from this seizure and found his temperature to be  $102^{\circ}$ . After this there was paralysis of the right side, though not quite complete, and during that night he was in a state of somnolence, with heavy and laboured breathing. He spoke very little after this attack. The day following I asked Dr. Finlayson to see the patient with me in consultation when, just as our examination was completed, the patient had another seizure, this time with twitchings of the face and foaming at the mouth. After a time he partially recovered consciousness, was able to swallow and spoke a little. He remained in a state of stupor, capable, however, when roused, of giving an intelligent answer, till the next day, Saturday, the 20th September, when he became quite comatose in the afternoon, and continued in that condition till 11 P.M., when he died, 13 days after the beginning of the acute illness.

The autopsy was kindly made by Dr. Coats, who furnished me with the following notes:—

On opening the skull the brain exhaled a very remarkable putrid sour odour. In removing the brain the left temporo-sphenoidal lobe was found to be adherent to the base of the skull by its inferior surface. On this surface the brain had a dark blue colour, and the whole inferior part of the temporo-sphenoidal lobe felt pulpy, while the convolutions were seen to be flattened or spread out so as to appear as if partially obliterated. On cutting into this lobe an abscess was found. Its contents were a dirty, greenish, decomposing pus, of a glairy consistence, and exhaling an exceedingly offensive, almost gangrenous, odour. The abscess was lined by a layer of soft consistence and of a dark bluish colour. The part specially occupied by the abscess was the external and inferior portions of the temporo-sphenoidal lobe, but it may be said that the greater part of the lobe was involved, except its extreme posterior portion. Over the temporal bone the dura mater was adherent and of a blue colour—at one place it had become pulpy.

The left temporal bone was removed from the skull by Dr. Coats, in order that I might examine it carefully at home.

On separating the dura mater, I found two pretty large

carious openings communicating with the mastoid cells, the larger one was situated at the groove for the lateral sinus, the other was found in the roof of the mastoid cells behind the tympanum and over the antrum mastoideum, the largest of the cavities in the mastoid bone. Water injected by the external auditory canal passed out of these two openings. The dura mater forming the walls of the lateral sinus was much thickened, both at the carious opening and for a distance above and below it, as if a compensatory act of nature for guarding against hæmorrhage. The dura mater covering the carious opening in the roof of the middle ear was also considerably thickened. I washed out a quantity of a very fetid dark substance, looking like a mixture of blood and pus, from the tympanum and mastoid cells with a syringe.

On cutting away the anterior wall of the external auditory canal, another carious opening was seen at the inner end of the canal in the upper and back wall—this also communicated with the mastoid cells. The upper half of the membrane was destroyed, the lower half had a small part of the handle of the malleus still adhering.

I did not completely open the tympanum, as I desired that the carious openings should remain undisturbed.

A fourth opening, also made by caries, was found passing irregularly through the squamous part of the temporal bone, its inner extremity being situated a little above and behind the groove for the lateral sinus. This somewhat remarkable perforation of the wall of the skull had not caused any appearance on the surface of the head during life, nor had that particular spot, so far as could be ascertained, at any time been complained of.

CASE III.—D. D. S., a boy 12 years of age, suffered from an attack of measles at the age of 6 years, since which there had been a discharge from the left ear. He was always considered a delicate boy, and was subject to bronchitis, though usually spirited and fond of play. His father suffers from hip-joint disease. The discharge from the ear was intermittent until some months before death, during which it was continuous. There was occasionally some pain, though not severe, when, as the mother remarked, "the ear was gathering." The discharge was always of an offensive smell, latterly extremely so, and frequently tinged with blood. The hearing was very defective on the left side.

On Sunday, the 28th December, 1879, when he returned from the Sunday school in the evening, he was seized with great pain in the region of the left ear and in the back of the head, but it was most severe behind the ear over the mastoid



region. He complained of a shivering sensation, especially in the head, which was attributed at the time to the fact that his hair had been cut on the previous day. For months before he had occasionally remarked to his mother that he had a peculiar "creeping, shivery" sensation in the head.

There was severe vomiting for the first three or four days. It began on the Sunday night, continued the whole of Monday and Tuesday, on Wednesday not so frequently, and only once on Thursday. During that time the vomiting was not connected with the taking of food, of which he ate very little. His thirst was great. There was great heat of skin, and the face was flushed and pale by turns. The bowels were confined, and remained so during the whole course of the disease, being relieved by occasional teaspoonful doses of compound liquorice powder.

The pain of head and back of ear was agonising for the first two days, but afterwards became less, although, till the end of this illness, he seemed to have some pain. On Thursday, the 1st January, Dr. William Chalmers, who was in attendance, applied two leeches over the mastoid process. On the day following blistering fluid was painted over the same region, while two days after that a cantharides plaster was put over the temple. The leeches removed a good quantity of blood, and the blisters "rose" well. These remedies were understood to have relieved the pain. At the end of the first week severe rigors began, lasting at first about twenty minutes, while afterwards they continued as long as an hour. They were followed by heat and then by sweating. The shivering was said always to begin in the head.

On Monday, 5th January, I saw him for the first time. He lay on his back pale and drowsy, but easily roused, when he gave intelligent answers to questions, and seemed to observe with attention what was going on. I cleaned out the external auditory canal of a quantity of offensively smelling pus, and found the tympanic membrane almost completely destroyed, and the exposed mucous lining of the tympanum covered with exuberant granulations which easily bled. Externally, at the junction of the mastoid and squamous parts of the temporal bone, there was some œdema and tenderness on pressure, but there was some doubt whether it might not be connected with the blisters. The question of making a free incision at that part was considered, but it was decided to wait and watch closely. There was neither œdema nor swelling over the mastoid process itself. In a day or two the œdema and tenderness passed off, and there seemed no indication for

cutting into the bone. Meanwhile, these rigors continued three or four times a day, and as often by night, and the parents assert that during these attacks he was unconscious, with stertorous breathing, and sometimes the eyes were half open with eyeballs turned up. In these attacks the bowels and bladder often acted involuntarily in bed. The most severe attack took place on Saturday, the 17th January, when he lay the whole forenoon in an unconscious state. There were general tremors and stertorous breathing, the nose and brow were cold, and the face pale. He recovered from this in the afternoon, and conversed intelligently with his mother. On Sunday, the 18th January, exactly three weeks from the onset of this illness, he sunk into a completely unconscious state, with eyes open and fixed and pupils dilated, and died at noon.

Permission was given to examine the head, and Dr. Foulis very kindly accompanied me on Monday evening and made the *post-mortem*. On opening the skull no meningitis or cerebritis was detected, but on removing the brain a very fetid odour arose, which was found to be due to a circumscribed collection of fetid pus under the dura mater in contact with the inner surface of the mastoid process and posterior surface of the petrous bone on the left side, just at the groove for the lateral sinus. The walls of the lateral sinus were thickened, and along with the neighbouring dura mater, were separated from the bone by the collection of pus. There was no pus in the lateral sinus. The brain itself was healthy, with the exception of a slight discoloration of the surface immediately over the abscess.

The left tympanic membrane was gone and the lining of the tympanum soft, tumid, and greyish-red, and none of the ossicles were found with the exception of a part of the malleus, which was eroded. The mastoid cells were full of whitish-cheesy looking fetid matter, evidently dried pus, and the cavities in the bone were larger than those on the opposite side, but no evidence of caries could be found in any part of the temporal bone. On the right side the tympanum contained a quantity of viscid mucus. The lining membrane was reddened and slightly tumid.

The third case was properly one of suppurative inflammation of the dura mater; but I have included it here, as it was really an abscess pressing on the substance of the brain, and therefore likely to cause phenomena similar to a collection of matter in the interior of the brain, the difference being merely one of position.



An interesting question arises here—What is the proportion of cases of cerebral abscess dependent upon suppuration in the ear? Sir William Gull and Dr. Sutton, in their article on abscess of the brain in Reynold's *System of Medicine*, assert that disease of the middle ear is the commonest cause of that condition. Of 76 cases given in that article, 27, or rather more than one third, were consequent on ear disease. Professor Lebert, who has treated this subject probably more fully than any other writer, in his article, "Ueber Gehirnbrabscesse," in Virchow's *Archiv*, gives the proportion, based upon 80 cases of cerebral abscess, as one in 4. I believe, however, with Dr. von Tröltzsch, that "when we review the cases dispersed in the special aural literature, the conclusion must be arrived at that ear affections constitute far more frequently, perhaps in a half of the cases, the exciting cause of abscess in the brain."

There is no doubt that hitherto, in *post-mortem* examinations, the hearing organ has generally been overlooked in consequence of the difficulty of opening the middle ear, but my friend Dr. Foulis has inaugurated a new era in the section of the ear after death as a matter of routine in *post-mortem* examination. By his very ready and expeditious method the middle ear can be opened without the removal of the temporal bone from the skull, and its condition very fairly seen. It is to be hoped that Dr. Foulis, with his unsurpassed opportunities in the Glasgow Royal Infirmary, will be able to add very materially to our knowledge of the pathology of this organ. I think it is probable that persons often die of cerebral disease originating in the ear, while its aural origin has been undetected in consequence of the friends of the patient not deeming the "running ear" worthy of being mentioned to the medical man. Besides, we must bear in mind that cases are on record where no discharge appeared from the ear, the matter escaping by the Eustachian tube.

In these three cases, which I have brought before you to-night, there are a few points to which I beg to direct your attention.

1. *The Origin and Course of the Ear Affection*.—Two arose out of measles, in the one the discharge had lasted for ten years, and in the other for four years. One was evidently catarrhal in its origin, and had a history of only two years discharge. It is well known that the most serious cases of suppuration of the ear are sequelæ of measles or scarlet fever. In all, the discharge was fetid, not, as these cases prove, a true indication of caries. Fœtor from an ear discharge simply means retention and decomposition of the pus. The family

history was strumous or tubercular, unless in the first case, which had the most acute, or, as we may say, sthenic course. No proper treatment had been adopted for the otorrhœa in any of the cases.

2. *In Regard to the Beginning of the Cerebral Disease.*—We know that abscess in the brain has often a latent course, that extensive destruction of the brain may take place without there being any symptom of cerebral disease. In the second case, the abscess had evidently existed for some weeks or months before the acute symptoms began, judging from the appearance of the walls of the abscess. The only symptom manifested during that time having been occasional pain in the head. In all three, the onset of the acute symptoms was signalised by pain in the head. In the first case, this symptom was most intense, and continued till the last day, when convulsions and coma set in, and terminated life. In all three, the pain was localised in the same side as the ear disease. In the second case, where the caries existed, there was least pain, and in the third case, the pain was chiefly in the mastoid region, corresponding with the seat of the abscess, and also in the back of the head. Lebert observes that when the abscess is in the cerebellum, the pain often extends to the back of the head. Pain in the head is a most important symptom in abscess of the brain, and existed in two-thirds of Lebert's 80 cases. In one of the above cases, the most acute, the pain began after a blow on the head. Writers refer to the dangers of injury in chronic ear discharge. Vomiting was present at the commencement in all three cases. It was most prolonged and violent in the first, and also in the third, where the abscess was due to inflammation of the dura mater. Recorded cases show that vomiting occurs in only a fourth of the number, and therefore it is not so constant a symptom as pain.

3. *Disturbance of the Intelligence.*—There is probably less disturbance of the intelligence in cerebral abscess than in any other disease of the brain. There was no delirium except in the last case, where the dura mater was mainly involved, and the pressure of the abscess was exerted upon the cerebellum. Only in a fourth of Lebert's cases was there distinct delirium.

I have not seen, in any recorded cases of cerebral abscess, aphasia as one of the phenomena. In the second case, where this symptom was noticed, the convolution of Broca was not involved directly in the abscess, but probably the compression exercised on this part by the collection of matter in the immediate vicinity accounted for its function being involved.

Drowsiness, stupor, and coma, are frequent phenomena

observed in intra-cranial abscess. In all my cases death took place by coma. In the first, an epileptiform convulsion ended life after two weeks of great excitement. In the other two, where the constitutional condition was not so good, the cerebral symptoms were more those of depression. The drowsiness and stupor were marked, and, instead of distinct convulsive attacks, there were general tremors, more like shivering, along with coma. In the third, the frequent repetition of this comatose condition, with intervals of consciousness, was a noteworthy feature. Paralytic phenomena were observed in one only. It was hemiplegia, and followed the aphasia and the comatose seizure. The convulsions of cerebral abscess have been observed to be much more inclined to be local than to be general.

The duration of the acute cerebral disease was, respectively, eleven, thirteen, and twenty-one days. Lebert's cases ranged from two to three weeks. The ages of my patients were 12, 14, and 17 years. The half of Lebert's cases were between 15 and 30 years of age. Cerebral abscess predominates in earlier life, the period when suppurative ear diseases are much more frequently met with. It is also noteworthy that twice as many cases occur in males as in females.

With respect to the condition of the parts found after death, you will have noticed that in one case only were there carious openings between the pus secreting cavities of the middle ear and the dura mater. The most common situation for caries in such cases is the roof of the middle ear and the inner wall of the mastoid process. My second case had carious openings in these two situations. It has, however, been long established by numerous observations in the dead body, that suppurative diseases of the ear may bring about a fatal issue, without a carious affection. The disease may be conducted to the dura mater by the numerous foramina in the bone, for the passage of vessels, nerves, and connective tissue; or, if by destruction of the two fenestral membranes, the vestibule and cochlea are invaded by the disease, there would then lie, between the seat of the inflammation and the meninges, only the perforated lamella of bone through which the fibres of the auditory nerve pass. In all three cases the dura mater was thickened and softened, over the tegmen tympani in the first case, over the carious openings in the second, and over the inner surface of the mastoid process in the third. In the formation of such abscesses, the affection of the dura mater is probably the primary condition. It is to be remembered that the blood



supply to the middle ear is derived, in part, from within the cranium, and the veins which carry away the effete matters from the ear pass partly inwards through the bone to the dura mater. There may be readily developed, out of the diseased condition of the ear, morbid changes in the walls of the vessels, which, by passing along to the dura mater, may set up inflammation of that membrane, or to the sinuses, may excite phlebitis, with the attendant danger of the formation of thrombi and purulent depositions in other organs; then there is the possible introduction into the blood-vessels of the purulent matter with bacteria, and the disastrous consequences to the general organism which would thereby ensue. After the dura mater is involved, the inflammatory condition probably passes to the brain by contiguity of tissue, as there is no direct vascular or lymphatic connection between the dura mater and the substance of the brain.

How is the great fœtor of the pus in the brain to be accounted for? How do the bacteria get admission to the purulent matter when there is no actual opening in the dura mater or bone, and no direct vascular connection? These are questions regarding which I should gladly hear the views of any member of the Society, and especially of Dr. Coats and Dr. Foulis; also, how the extension from the middle ear of the suppurative process takes place, when a portion of healthy brain substance intervenes between the dura mater and the abscess.